Northern Territory Government

# Mathematics Space

# Mathematics

# Space

## Outcome

### Key Growth Point 1

Learners use intentional communication strategies to interact with people, objects and activities.

Learners demonstrating solid evidence of

**S KGP 1 Space**

- actively seek and anticipate interactions with familiar people, activities, objects and environments
- use a limited repertoire of gestures, actions and vocalisation strategies to respond to a sensory cue

**KGP 2**

Learners describe 3D objects, 2D shapes and lines through play, using everyday language. They visually discriminate between changes in the orientation of 3D objects and 2D shapes and describe positions of known everyday objects.

## Indicators

Key Growth Point 1 has three distinct developmental stages organised into six levels. The Key Growth Points Continuum on page two (2) describes the earlier stages of this development, whilst the indicators below provide the curriculum scope for planning and assessing learning within **Key Growth Point 1.**

**Level 5 Anticipate**

- choose from a limited range of responses to seek attention, request and respond to people, materials, objects, activities, eg show excitement or protest when presented with familiar objects, activities, environments; reach out toward a familiar object
- explore materials and objects, eg reach out to explore the position of objects
- seek objects that may not exist in immediate environment, eg actively look for or request objects
- participate in shared activities with intermittent prompts and cues, eg copy some actions during number rhymes, songs and number games
- sustain concentration for short periods of time
- observe the results of their own actions with interest, eg notice changes in visual or auditory input as a result of touching an object
- remember learnt responses over more extended periods, eg return to or request favourite number games
- make simple choices, eg use a yes/no system when presented with one option or reach for preferred object when presented with two objects

# Mathematics Key Growth Points Learning Continuum

| Awareness | Engagement | Participation |
|---|---|---|
| **Level 1 Tolerate**<br>Learners allow themselves to be involved in an activity prompted by a familiar person.<br>Learners are able to<br>• produce simple reflex responses in response to the sensations they are experiencing, eg vocalisation, eye rolling, actions in response to feeling pain<br>• produce simple reflex responses in response to external stimuli, eg startle reflex to a loud noise<br>• rely on communication partner to prompt interaction | **Level 3 Respond**<br>Learners change their body language in a more sustained and consistent way.<br>Learners are able to<br>• respond consistently to and show interest in familiar people, events and objects, eg pointing to known objects or people<br>• react to new experiences, eg move towards an object, sound or movement source<br>• accept and engage in co-active exploration of objects and environments, eg reaching out and feeling for objects as tactile cues to events | **Level 5 Anticipate**<br>Learners use intentional communication strategies to interact with people, objects and activities.<br>Learners are able to<br>• choose from a limited range of responses to seek attention, request and respond to people, materials, objects, activities, eg show excitement or protest when presented with familiar objects, activities, environments; reach out toward a familiar object<br>• explore materials and objects, eg reach out to explore the position of objects<br>• seek objects that may not exist in immediate environment, eg actively look for or request objects<br>• participate in shared activities with intermittent prompts and cues, eg copy some actions during number rhymes, songs and number games<br>• sustain concentration for short periods of time<br>• observe the results of their own actions with interest, eg notice changes in visual or auditory input as a result of touching an object<br>• remember learnt responses over more extended periods, eg return to or request favourite number games<br>• make simple choices, eg use a yes/no system when presented with one option or reach for preferred object when presented with two objects |
| **Level 2 React**<br>Learners respond to a stimulus.<br>Learners are able to<br>• take part in interactions, activities and experiences through body language, actions, vocalisations, eg attend briefly to lights, sounds or patterns of movement<br>• intermittently appear alert and focus attention on certain people, objects or parts of objects, and experiences, eg focus on sensory aspects of stories or rhymes when prompted<br>• give unexpected or intermittent reactions within an interaction, activity or experience, eg become excited in the midst of social activity | **Level 4 Focus**<br>Learners respond purposefully to a stimulus.<br>Learners are able to<br>• communicate consistent preferences and affective responses, eg reach out for favourite person<br>• recognise familiar people, objects and experiences, eg recall an object that has been placed out of sight<br>• perform actions by trial, error and improvement, eg hitting a mathematical shape on a concept keyboard to make it appear | **Level 6 Choose**<br>Learners request stimulus through gesture, action or vocalisation and are able to make a choice or express a preference.<br>Learners are able to<br>• request interactions and activities with consistent use of gesture, actions or vocalisations, eg prompt another person to join in an activity<br>• use learned responses over increasing periods of time to engage in activities and anticipate future events, eg indicate an area of the yard to go to<br>• respond to options presented with actions, gestures and/or vocalisations clearly expressing their preference<br>• attempt to solve problems systematically, eg bring an object to an adult in order to request a new activity<br>• choose to select or reject from a number of presented options within and outside experiences, eg choose to taste new foods |

# Mathematics

# Space

## Outcome

### Key Growth Point 2

**KGP 1**

Learners use intentional communication strategies to interact with people, objects and activities.

Learners describe 3D objects, 2D shapes and lines through play, using everyday language. They visually discriminate between changes in the orientation of 3D objects and 2D shapes and describe positions of known everyday objects.

Learners demonstrating solid evidence of

**S KGP 2.1 3D objects and 2D shapes**

- recognise and describe 3D objects, 2D shapes and lines using everyday language

**S KGP 2.2 Lines and Angles**

- identify, draw and describe lines using everyday language

**S KGP 2.3 Transformations**

- recognise, use and describe single transformations in 3D objects and drawings

**S KGP 2.4 Location**

- describe the position of nominated everyday objects in familiar locations

**KGP 3**

Learners identify and name common geometric 2D shapes, locate these shapes within the physical environment and make links between these shapes and the physical function of corresponding objects. They correctly use and interpret positional and directional language.

## Indicators

The curriculum scope for planning and assessing learning within **Key Growth Point 2**

| Knowledge and skills | Working mathematically |
|---|---|
| **3D objects and 2D shapes** | **3D objects and 2D shapes** |
| **3D objects** | **3D objects** |
| • use everyday language to describe the spatial appearance of 3D objects, eg 'It looks like an egg' or 'It's a box' | • match and manipulate 3D objects in 'fit-and-fix' constructions such as Lego |
| • describe spatial features of 3D objects, eg round, flat, open, closed | • stack and pack 3D objects with flat surfaces |
| • sort and match objects that are the same as each other in some way | • use everyday materials to build models, eg toilet rolls, egg cartons |
| • identify corners in everyday objects, eg toys, buildings, table tops | • create models using a variety of materials, eg play dough, carton collages |
| **2D shapes** | **2D shapes** |
| • identify simple 2D shapes in the environment: circle, square, triangle and rectangle | • draw and cut different 2D shapes in a variety of sizes to make a collage |
| • describe features of 2D shapes using everyday language, eg round, narrow, pointy | • create representations of familiar 3D objects using attribute blocks, eg place a triangle above a rectangle to represent a house |
| • sort and match simple 2D shapes according to spatial features, eg number of corners | • create and fill 2D shapes using a software package on a computer |

# Indicators

The curriculum scope for planning and assessing learning within **Key Growth Point 2 (cont)**

| Knowledge and skills | Working mathematically |
|---|---|
| **2D shapes**<br>• match 2D shapes in the environment with pictures or representations of the shape, eg a square is like a sandwich, a rectangle is like a door | **Lines and angles**<br>• draw a selection of lines using a software package on a computer, eg flat (horizontal), tall (vertical), leaning (diagonal), wavy, thick, thin, curved<br>• identify edges and corners in everyday 3D objects |
| **Lines and angles**<br>• identify, copy and continue straight and curved lines<br>• describe the features of lines, eg a long line, the thickest line, a wavy line | **Transformations**<br>• flip, slide and turn 2D shapes to create collages and patterns<br>• flip, slide, turn and enlarge or reduce 2D shapes to make a picture using a software package on a computer, eg using Paint<br>• turn and slide pieces to solve a jigsaw puzzle of up to five pieces<br>• use a fold line to produce symmetrical pictures by painting, cutting, folding, pressing or freehand and describe the resulting symmetry using everyday language |
| **Transformations**<br>• flip, slide and turn 3D objects and use everyday language to describe change, eg 'the box slid', 'the top spins', 'the key turns'<br>• create 'mirror images', eg by paper folding with paint blobs | |
| **Location**<br>• respond to simple instructions and everyday language of position and movement: forward, backward, over, under, up, down, in and out, eg move forward two steps<br>• describe, using everyday language, own position in immediate environment<br>• draw pictures/make models showing relative position of two or more everyday objects or people<br>• demonstrate an awareness of the location of other places in a familiar environment, eg frequently visited areas within the school such as the library, assembly area, canteen<br>• demonstrate awareness of permanent/current location of everyday objects in environment, eg can describe location of the sink<br>• indicate, verbally or non-verbally, an awareness of movement of 3D objects or self, eg suggest 'I am walking to the door.' | **Location**<br>• participate in activities that require simple movements, eg games and dances<br>• show family members to specific parts of the school, eg the school office<br>• draw pictures of familiar locations showing key features<br>• arrange everyday objects for a purpose, eg put chairs in a row to make a train<br>• replace everyday objects in their correct place at pack-up time<br>• describe the location of their own belongings<br>• place everyday objects in a specific location, eg hat on the desk, bag next to the door |

## Indicators

The curriculum scope for planning and assessing learning within **Key Growth Point 2 (cont)**

| **Key Mathematical Language** |
|---|
| **3D objects:** object, round, straight, flat, pointy, open, box, same, different, stack, pack, roll, fit/does not, sort, match, build, roll |
| **2D shapes:** shape, large, big, small, circle, square, triangle, ball, top, bottom |
| **Lines and Angles:** line**,** straight, curved, standing (vertical), sleeping (horizontal), leaning (diagonal) |
| **Transformations:** turn it over (flip), slide, turn it around, pattern, beginning, start, finish |
| **Location:** forwards, backwards, over, under, behind, beneath, underneath, in between, middle, opposite, up, down, around, in/inside, out/outside, in front, on top, on bottom, above, high above, below, beside, next to, here, there, near, far |

# Mathematics

# Space

## Outcome

### Key Growth Point 3

**KGP 2**

Learners describe 3D objects, 2D shapes and lines through play, using everyday language. They visually discriminate between changes in the orientation of 3D objects and 2D shapes and describe positions of known everyday objects.

Learners identify and name common geometric 2D shapes, locate these shapes within the physical environment and make links between these shapes and the physical function of corresponding objects. They correctly use and interpret positional and directional language.

Learners demonstrating solid evidence of

**S KGP 3.1 3D objects and 2D shapes**

- identify some common 2D shapes; demonstrate understanding of the relationship between the shape of objects and their function

**S KGP 3.2 Lines and Angles**

- identify, describe and draw lines and pairs of lines, in different orientations

**S KGP 3.3 Transformations**

- transform a variety of objects and shapes and demonstrate an awareness of relationship between shape and function

**S KGP 3.4 Location**

- give and follow directions in familiar environments

**Band 1**

Learners name and construct some familiar 3D objects, name and represent a range of 2D shapes and identify some of their features. They create maps from a personal perspective to describe familiar locations.

## Indicators

The curriculum scope for planning and assessing learning within **Key Growth Point 3**

| Knowledge and skills | Working mathematically |
|---|---|
| **3D objects and 2D shapes**<br>**3D objects**<br>• manipulate, sort and compare 3D objects by colour, size, shape and function<br>• demonstrate awareness of shape and function of 3D objects, eg boxes stack easily on shelves, bowling ball rolls easily<br>• identify and describe features of familiar objects using everyday language, eg a ball is round, a table is flat<br>• predict and describe movement of 3D objects, eg round things roll | **3D objects and 2D shapes**<br>**3D objects**<br>• create models, using play dough, clay or egg cartons, that model real-world 3D objects, eg an insect, butterfly or dragonfly<br>• create constructions showing shape and function compatibility, eg cylindrical 3D objects for wheels<br>• create drawings showing 3D objects used for a particular function, eg cylinders for binoculars<br>• explore movement and arrangement of 3D objects that relate to spatial features, eg pack, roll, spin<br>• explain own sorting of 3D objects by spatial feature, flat faces, curved faces<br>• critique constructions based on criteria of how well it served it's purpose, eg Did the egg fit into the box? |

# Indicators

The curriculum scope for planning and assessing learning within **Key Growth Point 3 (cont)**

| Knowledge and skills | Working mathematically |
|---|---|
| **2D shapes** | **2D shapes** |
| • name and create representations of familiar 2D shapes including square, rectangle, circle, oval, triangle | • make pictures, collages and designs using a variety of 2D shapes and describe the shapes used in everyday language |
| • describe 2D shapes using everyday language: side, corner, straight, round | • create pictures and designs from 2D shapes using computer software, eg AutoShapes in MS Word |
| • describe how different 2D shapes suit a particular function, eg circles make good wheels | • identify 2D shapes in different orientations in the environment |
| • identify, sort and compare 2D shapes by colour, size, shape and function | • explain own sorting of collection of 2D shapes, eg by spatial features |
| • distinguish between circles, squares, rectangles and triangles | • ask and respond to questions that assist in the identification of a particular shape |
| **Lines and angles** | **Lines and angles** |
| In pictures, patterns or the environment: | • use everyday language to draw and describe a variety of lines in pictures and diagrams, eg 'sloping' lines to show falling rain, railway lines, crosses |
| • distinguish between lines that meet to create a closed shape and lines that make an open shape | • draw a closed curved line to make a familiar shape, eg draw and cut out a snake |
| • identify and describe the orientation of lines using everyday language, eg standing line, sleeping line, leaning line | • use computer software to 'fill' closed 2D shapes and experience what happens when attempting to 'fill' open shapes |
| • identify and draw straight and curved lines | • highlight pairs of lines in a picture or pattern that meet at a point |
| • distinguish between lines that cross and lines that do not cross | |
| **Transformation** | **Transformation** |
| • manipulate self, 3D objects and representations of 2D shapes following simple transformation instructions, eg move the triangle to the left and then down | • manipulate 2D shapes with purpose, eg turn and slide shapes to fit or match a given space, turn shapes to fit a jigsaw puzzle (up to 24 pieces), flip shapes to make a symmetrical pattern |
| • describe results of a transformation, eg 'I turned around' | • participate in movement activities that involve 'sliding', 'reflecting' and 'turning', eg dance and mime |
| • create symmetrical pictures or patterns, eg using folding and cutting or pattern blocks | • predict the results of putting together or separating 2D shapes |
| • create, continue and describe a repeating pattern using a range of materials, eg pattern blocks, coloured tiles, tessellation tiles | • manipulate and re-position simple 2D shapes and 3D objects using computer software by flipping, sliding, turning, enlarging and reducing |
| | • use a 'fold line' to produce symmetrical pictures by cutting, folding, painting, tracing and describe the effect |

## Indicators

The curriculum scope for planning and assessing learning within **Key Growth Point 3 (cont)**

| Knowledge and skills | Working mathematically |
|---|---|
| **Location** | **Location** |
| • make models or draw simple maps, eg 'mud map' of a local area with attention to proximity and order | • act out a children's story involving movement, position and orientation, eg Bears in the Night |
| • draw pictures or make models that demonstrate everyday language of position, eg draw a tree next to a house | • draw pictures to show foreground, background, and/or internal details, eg a square for a window on a house wall with a person 'behind' the window |
| • draw arrows to show 'direction' in pictures, diagrams and maps | • draw imaginary maps relating to the stories listened to or written |
| • use everyday language to describe relative position of: self to other objects, other objects to self and object in relation to other object, eg I am next to the chair, the book is on top of the block | • find and describe, using everyday language of position and movement, different ways to go to a variety of locations within a familiar environment, eg how to walk to the school library |
| • give and follow simple directions using everyday language of position and movement, eg move the book to the top of the pile | • interpret language of position to locate items hidden in environment/pictures |
| • read simple maps to determine the location of key features | |

**Key Mathematical Language**

**3D objects:** corners, sides, small, smaller, smallest, large, larger, largest, make it bigger, make it smaller, long, longer, longest, different, same, stack, straight, flat, curved, side, round, roll, spin

**2D shapes:** rectangle, oval, closed shape, open shape

**Lines and Angles:** angle, lines that 'cross', fold-line (line of symmetry), change, a reflection (as a flip)

**Transformations:** move left (slide), move right (slide), turn all the way around, repeating pattern

**Location:** distance, close to, towards, further away, far away, nearer, nearest, on its side, row, across

# Mathematics

# Space

## Outcome

### Band 1

**KGP 3**

Learners identify and name common geometric 2D shapes, locate these shapes within the physical environment and make links between these shapes and the physical function of corresponding objects. They correctly use and interpret positional and directional language.

Learners name and construct some familiar 3D objects, name and represent a range of 2D shapes and identify some of their features. They create maps from a personal perspective to describe familiar locations.

Learners demonstrating solid evidence of

**S 1.1 3D objects and 2D shapes**

- name and represent some familiar 3D objects and a range of 2D shapes and identify some of their features

**S 1.2 Lines and Angles**

- describe lines and their orientation using geometric language
- identify 'square corners'

**S 1.3 Transformations**

- recognise and describe symmetry
- apply transformations to create patterns and designs
- describe transformations using mathematical language

**S 1.4 Location**

- interpret and create maps, including use of grids and directional language to describe pathways

**Band 2**

Learners identify and list geometric features including comparative measures of angles for a range of 3D objects and 2D shapes. They sort and construct 3D objects and represent 2D shapes according to specified criteria. Learners describe the effects of transformations on 2D shapes. They interpret maps and plans which may include compass points, keys and grids.

## Indicators

The curriculum scope for planning and assessing learning within **Band 1**

| Knowledge and skills | Working mathematically |
|---|---|
| **3D objects and 2D shapes**<br>**3D objects**<br>• recognise, construct and sketch a range of common geometric 3D objects, eg cube, rectangular prism, sphere, cylinder and cone<br>• describe some of the features and functions of common geometric 3D objects using everyday language and some geometric terms including round, flat, corner (vertex), edge and face, eg 'a cube is a square-faced box'<br>• describe everyday 3D objects by identifying features such as faces, vertices and edges<br>• given a set of drawn 2D shapes, identify the 3D object with these as faces | **3D objects and 2D shapes**<br>**3D objects**<br>• construct 3D objects for a purpose using a provided net, eg making a gift box with lid<br>• use everyday 3D objects in constructions taking account of suitability of spatial features of object to purpose/appearance of construction, eg explain that a box was used for a house because its faces are like walls, floor and roof<br>• describe similarities and differences between two 3D objects, eg both the cone and the cylinder have a curved surface but only the cone has a vertex<br>• explain and critique choices in constructions by describing features of objects, eg describe edges and their orientation in the models created<br>• classify a set of 3D objects by spatial property, eg objects with one curved face |

# Indicators

The curriculum scope for planning and assessing learning within **Band 1 (cont)**

| Knowledge and skills | Working mathematically |
|---|---|
| **2D shapes** | **2D shapes** |
| • use and describe congruence of features in regular 2D shapes, eg the sides of a square are the same | • create a drawing or 'puzzle' from geometric 2D shapes with attention to the specific features, eg equal length of sides for squares, matching equal lengths to solve two/three piece puzzles |
| • describe faces of 3D objects using everyday and some geometric language including straight, curved, flat, corner, side, equal length and shape names, eg circle, hexagon | • create representations of 2D shapes in different orientations or sizes, using materials or computer software |
| • identify, sort, compare, describe and represent a range of regular geometric 2D shapes including pentagon, hexagon and octagon and some non regular examples, eg 'house shaped' pentagon | • describe features of 2D shapes seen in drawings, paintings, photographs and the environment |
| • pay attention to essential spatial features of common geometric 2D shapes (polygons) in drawings, eg sides are straight, closed and there are no 'crossover' lines | • identify the 2D shapes which make up a 3D object, eg square, triangle, circle |
| | • identify a shape from a description of its features |
| **Lines and angles** | **Lines and angles** |
| In pictures, patterns or the environment: | • highlight lines that are horizontal or vertical in pictures and patterns |
| • identify, name and draw lines and pairs of lines in different orientations, eg vertical, horizontal and diagonal | • distinguish horizontal, vertical and sloping lines in the classroom and use materials, eg streamers and blu-tac, to show or highlight lines |
| • use the term 'boundary' to describe a line enclosing a region; identify inside, outside and on the boundary | • identify examples of 'square corners' around the classroom by matching with a simple device such as a square pattern block or the corner of a sheet of paper |
| • identify and name a 'square corner', eg on an object (such as a door), a piece of paper, a geometric shape | • compare/contrast an angle, eg by overlaying a geometric shape on an object, in the environment |
| • construct and draw straight lines, curves and 'square corners', eg using pipe cleaners and drinking straws | |
| **Transformations** | **Transformations** |
| • identify a line of symmetry in 2D shapes by folding or using a 'Mira' | • draw symmetrical designs using computer software applications |
| • describe symmetry in pictures and patterns, or in paper-folding tasks, eg using everyday language explain why a picture or object is symmetrical | • manipulate an image using computer software; flip, slide, turn and resize 2D shapes or photographs |
| • identify, describe, and continue patterns based on flips, slides and turns | • make tessellating designs by flipping, sliding and turning regular 2D shapes, eg using pattern blocks |

## Indicators

The curriculum scope for planning and assessing learning within **Band 1 (cont)**

| Knowledge and skills | Working mathematically |
|---|---|
| **Transformations (cont)**<br>• describe the movement of a shape as a single flip, slide or turn<br>• distinguish between symmetrical and non-symmetrical 2D shapes, designs or pictures<br>• identify 2D shapes that do and do not tessellate | **Transformations (cont)**<br>• investigate whether 2D shapes or pictures have line symmetry using strategies such as folding or mirrors to confirm<br>• explain in own words what it is that makes a picture symmetrical<br>• predict that a simple shape will tessellate and explain prediction, then test. |
| **Location**<br>• create a map identifying key features in an area, ensuring that the proximity (not necessarily to scale) and orientation of features marked on the map correspond to those in the area<br>• respond to and use common movement, positional and directional language, including the language of turns (half, full, quarter, three-quarter) to move around familiar environments or to locate specific features<br>• identify/mark obvious locations and landmarks on simple maps and plans drawn on grids and simple coordinate systems, eg Where is the shop? What is at A7?<br>• respond to and use common positional and directional language when using simple maps and plans, eg move left three spaces | **Location**<br>• draw a simple map to provide directions to a location in a familiar environment and provide instructions, eg sketch a 'mud map' of how to walk from school to the shop; eg 'turn left and then turn right to go to the shop'<br>• use a variety of lines and 2D shapes/symbols to show different features/directions on simple maps, eg curved lines for water, features at specified locations, arrows to show direction<br>• play games/draw paths requiring movement around grids |

| Key Mathematical Language |
|---|
| **3D objects:** corners, faces, edges, prism, pyramid, sphere, cube, cone, cylinder, net |
| **2D shapes:** polygons, pentagon, hexagon, octagon, rhombus, trapezium, semi-circle, net, hollow, solid, kite |
| **Lines and Angles:** square corner, vertical, horizontal, boundary, arms, diagonal |
| **Transformations:** mirror, symmetry, flip, slide, turn, resize, edge to edge, no gaps (tessellate), line of symmetry, symmetrical, not symmetrical, shapes, objects |
| **Location:** position, co-ordinates, map, grid, centre, diagonal, path, track, birds-eye view, key, legend, left, right |

# Mathematics

# Space

## Outcome

### Band 2

**Band 1**
Learners name and construct some familiar 3D objects, name and represent a range of 2D shapes and identify some of their features.They create maps from a personal perspective to describe familiar locations.

Learners identify and list geometric features including comparative measures of angles for a range of 3D objects and 2D shapes. They sort and construct 3D objects and represent 2D shapes according to specified criteria. Learners transform 2D shapes. They interpret maps and plans which may include compass points, keys and grids.

Learners demonstrating solid evidence of

**S 2.1 3D objects and 2D shapes**

- compare and describe 3D objects and 2D shapes according to geometric features
- sketch or make models of 3D objects and 2D shapes according to geometric features

**S 2.2 Lines and Angles**

- describe specified lines and line pairs using geometric language
- identify angles in terms of their components

**S 2.3 Transformations**

- describe the effects of transformation
- identify multiple lines of symmetry

**S 2.4 Location**

- create or interpret maps and plans using grids, keys and key compass points

**Band 3**
Learners identify relevant properties of geometric 3D objects and 2D shapes in order to construct or classify them in accordance with formal definitions. They measure angles to the nearest degree and demonstrate a developing sense of scale and proportion, creating accurate scale maps and drawings.

## Indicators

The curriculum scope for planning and assessing learning within **Band 2**

| Knowledge and skills | Working mathematically |
|---|---|
| **3D objects and 2D shapes** | **3D objects and 2D shapes** |
| **3D objects** | **3D objects** |
| • represent 3D objects by making models using nets or straws and joiners | • make solid and skeletal models of pyramids and prisms using a variety of materials and provided nets |
| • represent geometric 3D objects by sketching, attempting to show depth | • cut boxes to produce nets |
| • sketch 3D objects from different views, ie front, top and side | • match 3D objects to their nets and nets to 3D objects |
| • identify geometric objects from list of spatial features, eg five flat faces, square base | • sort geometric 3D objects into sets according to specified features, eg objects with all flat surfaces, some flat surfaces, no flat surfaces |
| • compare and contrast the features of cylinders, cones and spheres | • predict and test which pentominoes can be folded to make an open box |
| • identify and name geometric 3D objects including cubes, cuboids, spheres, cones, cylinders | • write and illustrate the story of a geometric object describing its features |

# Indicators

The curriculum scope for planning and assessing learning within **Band 2 (cont)**

| Knowledge and skills | Working mathematically |
|---|---|
| **3D objects (cont)** | **3D objects (cont)** |
| • identify a cross-section of an object shown in a drawing | • predict cross-sections of geometric 3D objects then cut, draw and describe, using plasticine models cut with fishing line |
| **2D shapes** | **2D shapes** |
| • identify congruent 2D shapes by superimposing and comparing equality of sides and angles, eg tangram puzzles | • construct accurate representations of 2D shapes using a variety of media, eg straws and pipe cleaners, Meccano, paper, card, geoboards and computer software such Paint or Draw (MS Word) |
| • group 2D shapes using multiple features, eg parallel sides and right angles | • explore congruence of measurements and presence of right angles to distinguish between different types of triangles and quadrilaterals, eg distinguish squares from rhombuses, rectangles from parallelograms |
| • describe the features of 2D shapes using congruence of measurements, eg the opposite sides of a parallelogram are the same length | • for a named shape, sort examples from non-examples and justify choice, eg non-examples may not be fully closed, have curved sides while some examples may have extreme angles or be presented in atypical orientations |
| • identify and name polygons, including a range of quadrilaterals presented in different orientations | |
| • identify, compare and describe the features of triangles, including equilateral and right-angled | |
| **Lines and angles** | **Lines and angles** |
| In pictures, patterns or the environment: | • create patterns of parallel lines, eg draw lines both sides of a ruler, change orientation of ruler and repeat |
| • construct parallel and perpendicular lines using various tools and materials | • construct and use an informal ‘protractor’ to make comparative measures of different angles in the environment |
| • draw and describe angles of various sizes | • create patterns by fitting pattern blocks around a point |
| • compare angle size using informal means, eg by overlaying cut-out angles or pattern blocks or bending a pipe cleaner to match one angle then comparing this to another | • create tools using provided material and use to compare the size of angles, eg pipe-cleaners (to concretely record angles), cardboard wedges (to use as uniform angle units) |
| • compare angles, including those in the environment, to a right angle and describe as a right angle, smaller or larger than a right angle | • identify examples of parallel lines in the environment, eg the lines along the top and bottom of the white board |
| • identify the lines/arms and point in angles, eg in objects, pictures and patterns | • identify examples of perpendicular lines (or planes) in the environment, eg adjacent edges of a page |
| • recognise an angle in a turning or opening, eg opening and closing a pair of scissors, a door | • explore angle size using dynamic geometry software, eg Geogebra |
| • use the term oblique to describe lines that are neither horizontal nor vertical, eg in frame of bicycle | |
| • use the term perpendicular to describe two lines at right angles | |
| • use the term parallel to describe two lines that stay a constant distance apart and do not intersect | |

# Indicators

The curriculum scope for planning and assessing learning within **Band 2 (cont)**

| Knowledge and skills | Working mathematically |
|---|---|
| **Transformation** | **Transformation** |
| • enlarge or reduce a shape or picture using two differently scaled grids | • make tessellating designs by flipping, sliding and turning a shape, eg by tracing templates of 2D shapes or through using computer software |
| • identify multiple lines of symmetry in 2D shapes | • create or copy a picture using computer software where the process involves resizing, sliding and rotating the 2D shapes |
| • recognise a shape in different orientations, eg ¼ turn, ½ turn or full turn, clockwise or anticlockwise | • plan then manipulate 2D shapes and 3D objects to make a sculpture or mosaic |
| • describe some features of 2D shapes that allow tessellations | • visualise and reproduce the folds and cuts needed to create a simple 'doily' design for one and two folds |
| | • predict the effect of rotation on an object and manipulate the object to confirm |
| **Location** | **Location** |
| • construct a map or plan of a familiar location that includes a key of significant items and a simple coordinate grid (not necessarily to scale) | • play coordinate grid games, eg Hurkle |
| • give or follow instructions to move involving turning through a given rotation clockwise or anticlockwise or moving a given number of steps N, S, E or W (with compass points shown) | • create or follow instructions to move between two points following a sequence of instructions for distance, turn and compass direction, eg move North 20 paces, turn through a ¼ turn clockwise, move forward 15 paces. Where are you? |
| • locate a place or object using key compass directions, ie North, South, East or West | |
| • use a coordinate grid system on a local street map to identify/record specific items or places given the coordinates | |
| • interpret the key or legend on a map or plan to identify a specific item or place | |

| Key Mathematical Language |
|---|
| **3D objects:** vertex/vertices, front, top, side views, depth, cross-section, apex, cuboid |
| **2D shapes:** regular shape, irregular shape, decagon, heptagon, pentominoes |
| **Lines and Angles:** right angle, perpendicular lines, parallel lines, intersecting lines, oblique |
| **Transformations:** clockwise, half turn, quarter turn, anticlockwise, tessellation, cross-section |
| **Location:** route, North, South, East, West, boundary |

# Mathematics

# Space

## Outcome

### Band 3

**Band 2**

Learners identify and list geometric features including comparative measures of angles for a range of 3D objects and 2D shapes. They sort and construct 3D objects and represent 2D shapes according to specified criteria. Learners describe the effects of transformations on 2D shapes. They interpret maps and plans which may include compass points, keys and grids.

Learners identify relevant properties of geometric 3D objects and 2D shapes in order to construct or classify them in accordance with formal definitions. They measure angles to the nearest degree and demonstrate a developing sense of scale and proportion, creating accurate scale maps and drawings.

Learners demonstrating solid evidence of

**S 3.1 3D objects and 2D shapes**

- describe and classify 3D objects and 2D shapes using geometric language and with attention to the relationships between properties
- accurately draw and construct a range of 3D objects and 2D shapes with attention to geometric properties

**S 3.2 Lines and Angles**

- accurately measure and construct lines and angles
- classify angles using geometric language

**S 3.3 Transformations**

- identify transformational properties of 2D shapes and describe using geometric language
- enlarge and reduce 2D shapes using scale factors

**S 3.4 Location**

- create and interpret maps and plans using grids, positive coordinates, intermediate compass points and scales

**Band 4**

Learners describe classes of 2D shapes and the relationships between classes, in terms of the properties of their constituent shapes. They mentally manipulate geometric 3D objects and 2D shapes. They use coordinate systems to determine position.

## Indicators

The curriculum scope for planning and assessing learning within **Band 3**

| Knowledge and skills | Working mathematically |
|---|---|
| **3D objects and 2D shapes**<br>**3D objects**<br>• construct and describe geometric 3D objects with reference to defining properties<br>• recognise and draw different representations of geometric 3D objects including nets, perspective, isometric and orthogonal views, and cross-sections<br>• recognise and draw different representations of composite 3D objects, eg objects made from collections of identical cubes<br>• identify and list the features and properties of polyhedra, spheres, cylinders and cones using geometrical language, eg type of faces, number of faces, vertices, edges, shape of faces | **3D objects and 2D shapes**<br>**3D objects**<br>• design a net to make a given geometric object<br>• investigate how many different nets there are that will make a cube and justify answer<br>• make conjectures in relation to flexibility/rigidity, fragility/strength of structures and use 2D shapes<br>• suggest improvements to rigidity of structures<br>• construct an informal definition of polyhedra with respect to properties<br>• generalise properties of prisms and pyramids, ie what are the minimum properties required to define a prism/pyramid? |

# Indicators

The curriculum scope for planning and assessing learning within **Band 3 (cont)**

| Knowledge and skills | Working mathematically |
|---|---|
| **3D objects (cont)** | **3D objects (cont)** |
| • classify and identify given geometric 3D objects including prisms and pyramids with reference to identifying features and properties, eg this object is a prism because it has a congruent cross-section, it is a triangular prism because the shape of that cross-section is a triangle | • design and draw a plan for a construction composed of geometric 3D objects. Build and critique the construction. |
| **2D shapes** | **2D shapes** |
| • identify properties of diagonals of quadrilaterals | • investigate the properties of diagonals in quadrilaterals, eg angle of intersection, relative length, bisection |
| • recognise a diagonal line as one that joins non-adjacent corners of a shape, ie distinguish between oblique lines and diagonals | • construct an informal definition of polygons with respect to properties |
| • use templates, rulers, set squares, protractors and geometric software to accurately draw a range of 2D shapes including examples of different triangles, quadrilaterals, polygons and circles | • construct a 'mind map' to informally investigate the hierarchical structure of shape classification, eg show rectangles and rhombuses as subsets of parallelograms |
| • distinguish between regular and irregular polygons and describe properties of regular polygons | • construct circle based designs by following geometrical language-based instructions using either geometric software or compasses, pencil and ruler |
| • identify examples and non-examples of polygons and justify selection | • visualise the effect of specific folding/unfolding of 2D shapes then draw and check predicted shape. |
| • identify, describe and compare a range of quadrilaterals and triangles with reference to their features and properties | |
| • recognise and use geometric terms that define and describe a circle: circumference, radius, diameter, arc, chord | |
| **Lines and angles** | **Lines and angles** |
| • draw and accurately measure angles to the nearest degree using a variety of tools including a protractor | • use both physical and electronic protractors to measure on-screen angles |
| • identify angles in a variety of real situations, eg slope of a skate board track, angle of bounce of a ball from a wall, opening of scissors, angle of approach to goal in various sports | • investigate the properties of angles in different scalene and isosceles triangles, right angled versions of these and in different sized equilateral triangles, using paper folding or dynamic geometry software. |
| • identify the line and point in one-line angles, eg an opening door where the door edge is one arm of the angle and the other line is not visible | • investigate the properties of angles of polygons by direct measurement and through the use of dynamic geometric software, eg sum of interior angles of a rectangle |

## Indicators

The curriculum scope for planning and assessing learning within **Band 3 (cont)**

| Knowledge and skills | Working mathematically |
|---|---|
| **Lines and angles (cont)** | **Lines and angles (cont)** |
| • use geometric terms to describe angles and sizes of angles, ie lines, arms, vertex, acute, right, obtuse, straight, reflex, revolution(s) | • investigate the angle properties of tessellating 2D shapes, eg examine the angles around the point where three or more shapes meet |
| • use conventional notation to label points | • identify and estimate angles in real-life contexts such as sports or design, eg report on the goal scoring possibilities of different shooting angles in hockey |
| • recognise that the size of an angle is independent of the length of the arms | |
| **Transformations** | **Transformations** |
| • enlarge and reduce both dimensions of 2D shapes on grid paper given a scale factor of times two, or times a half | • use dynamic geometry software, eg Geogebra, to explore congruence and similarity in terms of the properties of the 2D shapes, ie magnitude and proportion of angles and side lengths |
| • transform and tessellate 2D shapes and describe in terms of translation, reflection, and rotation including multiple transformations | • use templates made by cutting shapes from the edge of a square and paste them on the opposite edge |
| • recognise the correct right hand side and left hand side of a 3D object's reflected image (chirality) | • create unique tessellating 2D shapes based on regular polygons, eg by drawing then cutting a simple line variation on one side of a square and translating this line to the opposite side or rotating to an adjacent side |
| • identify and describe line and rotational symmetry in 2D shapes, eg a parallelogram has no lines of symmetry but 2 points of rotational symmetry | • create designs which possess rotational symmetry |
| • describe similarity and congruence in 2D shapes | • solve tangrams |
| | • create words having line or rotational symmetry using upper-case letters that exhibit symmetry, eg CODE has horizontal symmetry |
| | • explore and conjecture why some regular polygons tessellate and others do not |
| | • derive ratio of sides for similar 2D shapes (for simple ratios only, eg 1:2 or 1:10) |
| | • solve spatial puzzles, eg complex jigsaw puzzles, the Soma Cube puzzle |
| **Location** | **Location** |
| • interpret and create maps and plans involving positive coordinates and intermediate compass points | • using a map, write or state directions to a particular location using a specific pathway |
| • calculate the distance between two locations or coordinates on a map given a simple scale | |

# Indicators

The curriculum scope for planning and assessing learning within **Band 3 (cont)**

| Knowledge and skills | Working mathematically |
|---|---|

**Location (cont)**

- match photographs of a scene to the positions, shown on a plan, from which the photographs were taken

| Key Mathematical Language |
|---|
| **3D objects:** three-dimensional, polyhedra, tetrahedron, heptagon, nonagon, hexahedron, icosahedron, dodecahedron, octahedron, square-based pyramid, triangle-based pyramid, square-based prism, triangle-based prism, flexibility, rigidity, uniform, concave, convex |
| **2D shapes:** two-dimensional, ellipse, quadrilateral, parallelogram, circumference, diameter, radius, chord, arc, right-angle, scalene, equilateral, isosceles, congruent, similar, concave, convex |
| **Lines and Angles:** acute angle, obtuse angle, reflex angle, straight angle,protractor, degree, revolution, axis |
| **Transformations:** rotate, translate, reflect, image, axis of rotational symmetry, orthogonal, isometric, perspective views, enlarge, magnification, reduce, ratio, object, image, distort, superimpose, chiral, chirality |
| **Location:** network, north-east, north-west, south-east, south-west, scale |

# Mathematics

# Space

## Outcome

### Band 4

**Band 3**

Learners identify the relevant properties of geometric 3D objects and 2D shapes in order to construct or classify them in accordance with formal definitions. They measure angles to the nearest degree and demonstrate a developing sense of scale and proportion, creating accurate scale maps and drawings.

Learners describe classes of 2D shapes and the relationships between classes, in terms of the properties of their constituent shapes. They mentally manipulate geometric 3D objects and 2D shapes. They use coordinate systems to determine position.

Learners demonstrating solid evidence of

**S 4.1 3D objects and 2D shapes**

- formally classify 3D objects and 2D shapes and specify the minimum properties required
- apply geometric definitions of shape to determine derived properties such as similarity and congruence

**S 4.2 Lines and Angles**

- use Pythagoras' theorem and deductive reasoning to solve length problems involving right-angled triangles
- use deductive reasoning to solve problems where a transversal intersects a pair of parallel lines

**S 4.3 Transformations**

- draw, describe and quantify the dilation, reduction and distortion of 3D objects and 2D shapes with particular reference to properties
- create or interpret 2D representations of 3D objects and recreate a 3D object from representations of front and side elevations

**S 4.4 Location**

- use Cartesian coordinates, latitude and longitude, scale and bearings to determine the size and relative location of items in maps and plans

**Band 5**

Learners apply derived relationships, conjectures and theorems to solve problems involving geometric 3D objects and 2D shapes. They integrate location concepts with geometric relationships to conduct transformations and solve location problems.

## Indicators

The curriculum scope for planning and assessing learning within **Band 4**

| Knowledge and skills | Working mathematically |
|---|---|
| **3D objects and 2D shapes**<br>**3D objects**<br>• build 3D objects given a net, perspective, isometric and/or orthogonal views, and cross-section<br>• construct, describe and classify 3D objects, such as prisms and pyramids, according to their properties<br>• apply nomenclature to label some common objects, including tetrahedron, octahedron, dodecahedron and the classes of prism, eg triangular prism | **3D objects and 2D shapes**<br>**3D objects**<br>• explore and make representations of circles, ellipses, parabolas and hyperbolae arising from cross-sections of cones<br>• derive Euler's law through making and testing hypotheses |

# Indicators

The curriculum scope for planning and assessing learning within **Band 4 (cont)**

| Knowledge and skills | Working mathematically |
|---|---|
| **2D shapes** | **2D shapes** |
| • use geometric language to describe derived properties of triangles, eg incentre, circumcentre, centroid and orthocentre | • investigate the properties of polygons using dynamic geometry software, eg total angle sum and interior angles of regular polygons |
| • accurately draw and make models of a range of 2D shapes including different examples of triangles, quadrilaterals, polygons and circles to given specifications | • investigate effect of error introduced by rounding for regular polygons |
| • identify the relationships of angles within triangles and use these relationships to solve problems, eg sum of interior angles equals 180º, exterior angle equals the sum of the two opposite interior angles | • apply Pythagoras' theorem to solve practical problems, eg find the length of a ladder leaning against a wall |
| • use properties of 2D shapes to describe specific features including angles, side length and diagonals | • draw a right angled triangle with sides of 3, 4 and 5 units and draw squares on each side to confirm Pythagoras' theorem |
| • apply Pythagoras' theorem to determine the side length of a right-angled triangle given the other two side-lengths | |
| • manipulate Pythagoras' theorem to determine if a given triangle is right-angled | |
| • apply practical applications of similarity and congruence, eg shadow length to find height of immeasurable object | |
| • draw triangles to show incentre, circumcentre and centroid | |
| **Lines and angles** | **Lines and angles** |
| • construct angles in real-life situations, eg make and use a clinometer | • investigate the properties of angles using dynamic geometry software, eg effect of pivoting two lines at a point, or the intersection of a line with a pair of parallel lines, deriving or demonstrating conjectures |
| • accurately measure and draw angles using a variety of tools | |
| • identify angle relationships arising from the intersection of a transversal and a pair of parallel lines, ie vertically opposite, co-interior, corresponding and alternate angles | |
| • identify and estimate angles in real-life contexts, eg sports or design processes | |
| • identify and construct complementary and supplementary angles | |

## Indicators

The curriculum scope for planning and assessing learning within **Band 4 (cont)**

| Knowledge and skills | Working mathematically |
|---|---|
| **Transformations** | **Transformations** |
| • identify, describe and quantify line and rotational symmetry in 2D shapes and planes of symmetry in 3D objects, eg quantify rotational symmetry by using order of rotation | • create or interpret 2D representations of 3D objects or recreate an object from representations of front and side elevations |
| • identify congruent and similar 2D shapes given the minimum properties | • investigate the relationship between side length, face area and volume when scale factors are applied to 2D shapes and 3D objects, eg how does doubling the size of an object affect the side-length ratios, surface area and total volume? |
| • apply a specific scale factor to enlarge, dilate or distort 2D shapes using pencil/paper and ICT tools, or identify a scale factor given two similar shapes | |
| • classify transformations as congruent or similar | |
| **Location** | **Location** |
| • determine loci for circles, ellipses and simple polygons | • using a map, write or state directions to a particular location using a specific pathway |
| • match bearings in degrees with equivalent compass points | • use bearings to solve problems in cross-country navigation, eg an orienteering course |
| • use bearings (to the nearest degree) and distance to describe the position of one location with reference to another | • create a map of a location or a detailed plan of an object that uses coordinate systems and scales |
| • use ordered pairs to locate and plot points on a Cartesian plane | |

**Key Mathematical Language**

**3D objects:** centroid, incentre, circumcentre, circumradius, orthocentre, parabola, hyperbola, truncated, stellated, platonic solid, Johnson solid, anti-prism, ellipsoid, right-prism, Archimedean

**2D shapes:** sectors, segments, parabolas, hyperbolas, hypotenuse, Pi, circumscribe, locus, radius of arc, incircle, incentre, inradius, theorem, Pythagoras, adjacent, opposite, secant

**Lines and Angles:** point, midpoint, endpoint, line segment, major axis, minor axis, ray, adjacent, complementary, supplementary, equiangular, vertically opposite, co-interior, corresponding, alternate, bisector, transversal, interior angle, exterior angle, angle of elevation, angle of depression, perpendicular height

**Transformations:** plane of symmetry, bilateral symmetry, order of rotation, dilation, congruence, similarity, reflexible

**Location:** hemisphere, altitude, contour lines, bearings, scale factor, ratio, Cartesian plane, latitude, longitude, orientation, quadrants, ordered pairs, x-axis, y-axis, origin

# Mathematics

# Space

## Outcome

### Band 5

**Band 4**

Learners describe classes of 2D shapes and the relationships between classes, in terms of the properties of their constituent shapes. They mentally manipulate geometric 3D objects and 2D shapes. They use coordinate systems to determine position.

Learners apply derived relationships, conjectures and theorems to solve problems involving geometric 3D objects and 2D shapes. They integrate location concepts with geometric relationships to conduct transformations and solve location problems.

Learners demonstrating solid evidence of

**S 5.1 3D objects and 2D shapes**

- use relationships and deductive reasoning to determine unspecified properties of right-angled triangles (sine, cosine and tangent ratios) and to solve problems involving circle theorems
- determine properties of 2D shapes revealed by sectioning geometric 3D objects

**S 5.2 Lines and Angles**

- solve line and angle problems involving the logical manipulation of conjectures

**S 5.3 Transformations**

- apply quantitative transformations to geometric 2D shapes

**S 5.4 Location**

- use geometric models to determine position, bearings and distances in navigation problems

**Band 5+**

Learners apply knowledge of the relationships between geometric properties to conduct formal logical processes. They differentiate between conjectures and theorems, and locate errors in attempted deductive proofs. They transform geometric 2D shapes on a Cartesian plane. They plot and convert polar coordinates.

## Indicators

The curriculum scope for planning and assessing learning within **Band 5**

| Knowledge and skills | Working mathematically |
|---|---|
| **3D objects and 2D shapes**<br>**3D objects**<br>• determine derived properties of 3D objects where sections, or diagonals of sections, describe right-angled triangles, eg the length of a diagonal extending from the bottom left corner to the top right corner of a rectangular prism | **3D objects and 2D shapes**<br>**3D objects**<br>• model and generalise the properties of exposed faces (including magnitude) which arise from truncating cones and pyramids at different heights |
| **2D shapes**<br>• make pairs of triangles with given information on SSS, SAS, RHS, ASA theorems<br>• apply geometric proofs to triangles, ie SSS, SAS, RHS, ASA theorems to prove congruence and similarity<br>• use angles to solve real-life problems, eg trigonometric applications | **2D shapes**<br>• model geometric proofs using dynamic geometry software, eg use Geogebra to investigate circle theorems; angle formed by the tangent and a chord is equal to the angle in the alternate segment<br>• construct triangles to explore excentres and the associated circles |

# Indicators

The curriculum scope for planning and assessing learning within **Band 5 (cont)**

| Knowledge and skills | Working mathematically |
|---|---|
| **Lines and Angles**<br>• identify and use circle geometry laws to prove propositions and to determine specified lines and angles<br>• apply trigonometric ratios to solve problems including determining specified angles to the nearest degree and finding the length of specified intervals<br>• subdivide 2D shapes and use a combination of interior/exterior angles relationships, trigonometry and Pythagoras' theorem to determine the magnitude of specified angles or intervals | **Lines and Angles**<br>• model and investigate circle theorems using dynamic geometry software<br>• Construct diagrams to solve real-world trigonometric problems including those where angles of elevation or depression are involved |
| **Transformations**<br>• perform the following quantitative transformations on 2D shapes using graph paper: translations (specified vectors), rotations (given centre of rotation and angle in multiples of $90^0$), enlargements (given centre of enlargement and scale factor) and reflections (given mirror line) | **Transformations**<br>• use dynamic geometry software to investigate and describe the effect of negative scale factors<br>• solve problems involving the determination of the final size, orientation or position of shape after a specified quantitative translation |
| **Location**<br>• determine overall displacement from the point of origin when travel proceeds via a series of way points, ie the bearing and distance from each point in the sequence to the next is given<br>• calculate the distance between two locations, stated in terms of latitude and longitude, using great circles | **Location**<br>• explain why latitude for a specific location can be determined by measuring the angle of elevation of the sun at midday |

| **Key Mathematical Language** |
|---|
| proofs, excentre, great circles, waypoint, chord, tangent, sine, cosine, trigonometric ratio, minute, collinear, concurrent |

# Mathematics

# Space

## Outcome

### Band 5+

**Band 5**

Learners apply derived relationships, conjectures and theorems to solve problems involving geometric 3D objects and 2D shapes. They integrate location concepts with geometric relationships to conduct transformations and solve location problems.

Learners apply knowledge of the relationships between geometric properties to conduct formal logical processes. They differentiate between conjectures and theorems, and locate errors in attempted deductive proofs. They transform geometric 2D shapes on a Cartesian plane. They plot and convert polar coordinates.

Learners demonstrating solid evidence of

**S 5+.1 3D objects and 2D shapes**

- determine properties of non right-angled triangles or specify which other properties must be known in order to determine specified properties

**S 5+.2 Lines and Angles**

- construct and critique proofs and solve problems involving trigonometric identities

**S 5+.3 Transformations**

- apply quantitative transformations to geometric 2D shapes with reference to Cartesian coordinates

**S 5+.4 Location**

- plot and interpret polar coordinates and convert to Cartesian coordinates

## Indicators

The curriculum scope for planning and assessing learning within **Band 5+**

| Knowledge and skills | Working mathematically |
|---|---|
| **3D objects and 2D shapes** | **3D objects and 2D shapes** |
| **3D objects** | **3D objects** |
| • determine derived properties of 3D objects where sections, or diagonals of sections, describe non right-angled triangles, eg the length of a diagonal extending from the bottom left corner to the top right corner of a trapezoidal prism | • investigate and describe 3D objects formed by the rotation of curves |
| **2D shapes** | **2D shapes** |
| • apply sine rule and cosine rule to determine side lengths of triangles | • describe the derivation of the sine and cosine rules from the trigonometric ratios of right angled triangles |
| • apply sine rule to determine angles of triangles | • explain how the area of triangle rule is derived from trigonometric ratios |
| • apply area of triangle rule to determine area of triangles given two side lengths and the included angle | • solve area problems involving areas described by the rotation of lines with constraints, eg what area can a goat graze if it is tethered to the wall of a small shed? |

# Indicators

The curriculum scope for planning and assessing learning within **Band 5+ (cont)**

| Knowledge and skills | Working mathematically |
|---|---|
| **Lines and Angles** | **Lines and Angles** |
| • prove the equality of trigonometric equations using trigonometric identities,<br>eg prove that $\frac{-1}{\cos\theta} - \tan\theta.\sin\theta = \cos\theta$ | • use dynamic geometry software to model and manipulate a unit circle, describing the effect of various angles with respect to sign as a result of their related quadrants, eg what sign does $\cos 120^o$ possess and why?<br>• prove the Pythagorean Identity (ie $\sin 2\theta + \cos 2\theta = 1$) using knowledge of both trigonometric ratios and Pythagoras' theorem |
| • solve trigonometric equations involving identities and reciprocal identities including special triangles, eg those possessing exact trigonometric ratios ($30^o$, $45^o$, $60^o$) | |
| • apply trigonometric ratios to determine specified angles to the nearest minute, or determine intervals where angles are given to the nearest minute | |
| • use a calculator to convert between decimal fractions of degrees and degrees, minutes and seconds | |
| **Transformations** | **Transformations** |
| • determine the new coordinates of the vertices of a geometric shape given the coordinates of the original shape, the centre of enlargement and a scale factor<br>• given the formula for a mirror line, determine the new coordinates of a geometric shape undergoing reflection<br>• formulate a translation to move a specified shape to a given location and orientation | • create a set of instructions for describing a shape on the Cartesian plane and subjecting it to a number of translations such that it can be returned to its original position with a single translation involving a negative scale factor |
| **Location** | **Location** |
| • convert polar coordinates to Cartesian coordinates and vice versa<br>• create graphs of equations using polar coordinates by first creating a table of values, eg graph the equation R = 4 cos t | • use a graphical calculator to investigate the effect of changing the coefficient on polar graphs |

| Key Mathematical Language |
|---|
| trigonometric identity, Pythagorean identity, reciprocal identity, polar coordinate |